WHAT IS CLAIMED IS:

1. A cellular telephony searcher, comprising:

(a) a plurality of correlators for correlating a received signal with a pseudonoise sequence;

(b) an input mechanism for inputting said pseudonoise sequence into said correlators, each of said correlators receiving said pseudonoise sequence with a different delay; and

(c) a delay management mechanism for initializing said delays and subsequently changing said delays, said changing being contingent, for each said correlator, only on an output of said correlator.

2. The searcher of claim 1, wherein each said correlator correlates said received signal with said pseudonoise sequence at said respective delay for a correlation time selected from the group consisting of a first dwell time and a sum of said first dwell time and a second dwell time, said selection being performed separately for each said correlator.

3. The searcher of claim 1, wherein, for each said correlator, said delay management mechanism changes said delay corresponding to said each correlator if an estimated absolute value of said output of said each correlator is less than a threshold common to all said correlators, independent of an estimated absolute value of said output of any other said correlator.

correlations being performed with a different initial delay of said pseudonoise sequence, said initial correlations being performed for a first dwell time to produce, for each of said initial correlations, an initial first dwell time correlation value; and

(c) for each said initial correlation:

(i) if an estimated absolute value of said initial first dwell time correlation value exceeds a threshold, continuing to perform said each initial correlation,

(ii) otherwise, performing a first subsequent correlation of the received signal with said pseudonoise sequence at a first subsequent delay different from any of said initial delays;

wherein, if said performing of at least one of said initial correlations is continued and if at least one of said first subsequent correlations is performed, said continued performing of said at least one initial correlation and said performing of said at least one first subsequent correlation are effected simultaneously.

7. The method of claim 6, wherein, if a plurality of said first subsequent correlations are performed, said first subsequent delays all are mutually different.

8. The method of claim 6, wherein said continued performing of said initial correlations is effected for a second dwell time to produce a second dwell time correlation value.

9. The method of claim 8, wherein said second dwell time is an integral multiple of said first dwell time.

10. The method of claim 6, wherein successive said initial delays differ by a common increment.

11. The method of claim 10, wherein said pseudonoise sequence includes a plurality of chips generated at a certain chip interval, and wherein said common increment is an integral fraction of said chip interval.

12. The method of claim 6, wherein said first subsequent correlations are performed for said first dwell time to produce, for each of said first subsequent correlations, a subsequent first dwell time correlation value, the method further comprising the steps of:

(d) for each said first subsequent correlation:

(i) if an estimated absolute value of said subsequent first dwell time correlation value exceeds a threshold, continuing to perform said each first subsequent correlation;

(ii) otherwise, performing a second subsequent correlation of the received signal with said pseudonoise sequence at a second subsequent delay different from any of said initial delays and from any of said first subsequent delays.

13. The method of claim 12, wherein, if said performing of at least one continued correlation, selected from the group consisting of said initial correlations and said first subsequent correlations, is continued, and if at least one of said second subsequent correlations is performed, said continued performing of said at least one continued correlation and said performing of said at least one second subsequent correlation are effected simultaneously.

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14. The method of claim 6, further comprising the step of:

(d) if, after said simultaneous initial correlations are completed up to said first dwell time, all of said delays, whereat said initial correlations are continued and whereat said first subsequent correlations are performed, exceed a shortest initial delay, pausing said generating of said pseudonoise sequence.

15. The method of claim 14, wherein said pausing of said generating of said pseudonoise sequence is effected for a difference between a shortest said delay, whereat said initial correlations are continued and whereat said first subsequent correlations are performed, and said shortest initial delay.

16. The method of claim 6, wherein said correlations are performed using only arithmetical operations selected from the group consisting of additions and subtractions.

17. The method of claim 16, wherein each said correlation is performed as a sum of a plurality of terms, each said term being selected from the group consisting of the real part of a corresponding received value, a negative of the real part of said corresponding received value, the imaginary part of said corresponding received value, and a negative of the imaginary part of said corresponding received value.

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18. The method of claim 16, further comprising the step of:

(d) normalizing said correlations.

19. The method of claim 16, wherein each said correlation is performed as a sum of a plurality of terms, each said term being selected from the group consisting of a sum of the real part of a corresponding received value and the imaginary part of said corresponding received value, a negative of said sum of the real part of said corresponding received value and the imaginary part of said corresponding received value, a difference of the real part of said corresponding received value and the imaginary part of said corresponding received value, and a negative of said difference of the real part of said corresponding received value and the imaginary part of said corresponding received value.

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20. The method of claim 6, further comprising the step of:

(d) rotating said pseudonoise sequence by 45° prior to performing said correlations.

21. The method of claim 20, further comprising the step of:

(e) normalizing said correlations.

22. The method of claim 6, wherein said estimated absolute value of said initial first dwell time correlation value is a piecewise linear approximation of an exact absolute value of said initial first dwell time correlation value.

23. The method of claim 22, wherein said piecewise linear approximation is a piecewise linear combination of a larger of an absolute value of a real part of said initial first dwell time and an imaginary part of said initial first dwell time with a smaller of said absolute value of said real part of said initial first dwell time and said absolute value of said imaginary part of said initial first dwell time.

sequence into the correlators, each of the correlators receiving the pseudonoise sequence with a different delay; and (c) a delay management mechanism for initializing the delays and subsequently changing the delays, the changing being contingent, for each correlator, only on an output of the correlator.

According to the present invention there is provided, in a cellular telephony network including at least one base station and at least one mobile station, each of the at least one mobile station receiving a received signal from the at least one base station, the received signal including a plurality of received values, each received value having a real part and an imaginary part, a method for each of the at least one mobile station to identify at least one multipath channel to use to communicate with one of the at least one base station, including the steps of: (a) generating a pseudonoise sequence; (b) simultaneously performing a plurality of initial correlations of the received signal with the pseudonoise sequence, each of the initial correlations being performed with a different initial delay of the pseudonoise sequence, the initial correlations being performed for a first dwell time to produce, for each of the initial correlations, an initial first dwell time correlation value; and (c) for each initial correlation: (i) if an estimated absolute value of the initial first dwell time correlation value exceeds a threshold, continuing to perform the each initial correlation, (ii) otherwise, performing a first subsequent correlation of the received signal with the pseudonoise sequence at a first subsequent delay different from any of the initial delays; wherein, if the performing of at least one of the initial correlations is continued and if at least one of the first subsequent correlations is performed, the continued performing of the at least one initial correlation and the performing of the at least one first subsequent correlation are effected simultaneously.

Although the examples presented herein are of a cellular telephony system according to the IS-95 standard, it is to be understood that the principles of the present invention apply to any DSSS cellular telephony system. In addition, although the examples presented herein are directed at an implementation of a dual dwell algorithm, it will be clear to those skilled in the art how to apply the present invention to the implementation of a multiple dwell algorithm.

In the most general form of the present invention, the correlators correlate the received signal with the pseudonoise sequence at different trial delays, as initialized and changed periodically by the delay management mechanism. A correlator that succeeds in producing an output of sufficiently high absolute value is kept at its trial delay; a correlator that fails to produce an output of sufficiently high absolute value is moved to a different trial delay. The amount by which trial delays are changed depends on the outputs of all the correlators collectively; but the decision whether to change the trial delay of a specific correlator depends only on the output of that correlator, independent of the outputs of the other correlators. It is in this sense that the changing of a trial delay of a correlator is contingent only on the output of that correlator. This distinguishes the present invention from the prior art, in which all correlators are moved to new delays, or are not moved to new delays, in lock step.

More specifically, in the application of the present invention to multiple dwell algorithms generally, and to a dual dwell algorithm in particular, according to the present invention, if a correlator produces, after M chip durations, a correlation value that is less than the threshold, that correlator is assigned to a new delay in the window, and the correlation is repeated at the new delay, using this correlator, for another M chip durations. In this way, all the correlators are kept busy almost all the time.

Because of the more efficient use of the correlators according to the present invention, as compared with the relatively inefficient use of the correlators according to the prior art implementation of the dual dwell algorithm, the tradeoff between speed and efficient hardware utilization under the present invention allows the use of eight or more correlators, with the consequent increase in throughput *vs.* the prior art implementation.

For efficient implementation, N is made an integral multiple of M, typically $4M$. The time MT_C is referred to herein as the "first dwell time". The time $(N\text{-}M)T_C$ is referred to herein as the "second dwell time".

To allow this dynamic reassignment of correlators, a device of the present invention feeds the PN sequence from a PN sequence generator into a delay line. The delay line feeds multiple copies of the PN sequence, each copy at a different delay relative to the PN generator, to a multiplexer. Each correlator is provided with an index register, wherein is stored an index representative of the delay to which that correlator is assigned at any given time. The multiplexer reads the value stored in the index register and forwards the corresponding copy of the PN sequence to the correlator associated with that index register.

Each correlator has its own memory, each memory with a certain number R of registers. Periodically, after $y \leq R$ first dwell times, *i.e.*, after yM chip durations, an interrupt is generated and correlator outputs are read by system software. Correlator outputs that have been accumulated for a full N chip durations are used subsequently by system software to identify the strongest multipath components of the signals received from the neighboring base stations.

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4. The searcher of claim 1, wherein said input mechanism includes:

(i) a pseudonoise sequence generator for generating said pseudonoise sequence; and

(ii) a delay line for receiving said pseudonoise sequence and outputting a plurality of copies of said pseudonoise sequence, each said copy being outputted with a different said delay.

5. The searcher of claim 4, wherein said delay management mechanism includes:

(i) for each said correlator, an index register; and

(ii) a multiplexer for directing one of said copies of said pseudonoise sequence to each said correlator in accordance with an index value stored in said index register of said each correlator.

6. In a cellular telephony network including at least one base station and at least one mobile station, each of the at least one mobile station receiving a received signal from the at least one base station, the received signal including a plurality of received values, each said received value having a real part and an imaginary part, a method for each of the at least one mobile station to identify at least one multipath channel to use to communicate with one of the at least one base station, comprising the steps of:

(a) generating a pseudonoise sequence;

(b) simultaneously performing a plurality of initial correlations of the received signal with said pseudonoise sequence, each of said initial